Docket No.: 50103-404 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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6-6-03

In re Application of	:	
Chung-Hee CHANG, et al.	:	
Serial No.: 09/986,063	:	Group Art Unit: 1773
Filed: November 07, 2001	:	Examiner: Louis V. Falasco

For: PERPENDICULAR MAGNETIC RECORDING MEDIA WITH IMPROVED INTERLAYER

REQUEST FOR RECONSIDERATION

Mail Stop Non Fee Response
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The following remarks are submitted in response to the Official Action dated March 3, 2003.

Applicants affirm the prior provisional telephone election of the Group I claims 1-13, and 19-20.

Claims 1-20 are pending in this application; of these claims 14-18 stand withdrawn in view of the above election. Therefore, claims 1-13 and 19-20 are active, claims 1 and 19 being independent, with claims 2-13 directly or indirectly dependent from claim 1.

The Objection to the Disclosure

The Examiner objected to the Disclosure as informal due to incorporation of the Provisional Application thereinto by reference, on the basis "that a copy has not been [provided] and it has not been published nor available to the public, [and] further is not maintained for public use by the USPTO".

The above objection is traversed as improper and inappropriate, for the following reasons:

1. The Examiner is clearly incorrect in alleging failure to provide a copy of the Provisional Application as a basis for objection. A copy of the Provisional Application has been filed with the USPTO on March 7, 2001 and afforded a Serial No. of 60/274,098. Applicants are unaware of any requirement for filing an additional copy of the Provisional Application along with the regular application; and

2. The last 2 sentences of the paragraph "ACCESS TO PROVISIONAL APPLICATIONS" of MPEP section 103 states that "Provisional applications are also available in the same manner as any other application. For example, an application that is relied upon for priority in a U.S. patent and is abandoned is available under 37 CFR 1.14(e)(2)(i)".

Stated differently, provisional applications (which are automatically abandoned 1 year after filing) become available to the public in the same manner as any other application upon issuance of the corresponding regular application as a U.S. patent.

Accordingly, and in view of the above, reconsideration and withdrawal of the objection is respectfully solicited.

The 35 USC § 103 (a) Rejection

Claims 1-13 and 19-20 were rejected under 35 USC § 103 (a) "as being unpatentable over the admitted state of the prior art taken with Honda et al (US 5851643) in view of Futamoto et al (US 6403203)".

In stating the basis for rejection, the Examiner opined that "it would have been obvious to one having ordinary skill in the art at the time the invention was made to adopt the perpendicular recording compositions of Honda et al in the admittedly conventional perpendicular recording media and make adjustments as to characteristic crystal sizes, alloy blends and layer thickness shown by Futamoto et al for the purpose of controlling the sensitivity and coercivity of the perpendicular recording media."

The above rejection is traversed as improper, unwarranted, and untenable for the following reasons:

The Examiner's analysis of the "admitted prior art" as described in the instant specification clearly does not appear to afford full consideration of the specification description/discussion of the state of the art pertaining to perpendicular magnetic recording media at the time of applicants' invention. For example, as is taught at page 4, line 12 through page 6, line 9:

> "Another way of classifying perpendicular magnetic recording media into different types is based on the media properties provided by the material utilized for the magnetically hard recording layer. For example, as indicated above, the magnetically hard, perpendicular recording layer can comprise magnetic alloys which are typically

employed in longitudinal media, e.g., CoCr alloys, or multi-layer magnetic superlattice structures, such as the aforementioned $(CoX/Pd \text{ or } Pt)_n$ superlattice structures. Representative M-H hysteresis loops of magnetic recording layers comprised of these different types of materials are shown in FIG. 2(A) - 2(B). As is evident from FIG. 2(A) showing the M-H loop of a perpendicular recording medium comprising a CoCr alloy, such type media typically exhibit a relatively low coercivity, low remanent squareness, i.e., less than 1, and a positive nucleation field H_n. In addition, the occurrence of magnetic domain reversal within bits, caused by the presence of high demagnetization fields in CoCr-based perpendicular recording media, is problematic with such media in that the phenomenon is a significant source of media noise reducing the SMNR. A high remanent squareness and a negative nucleation field H_n are required in order to obtain good bit stability.

By contrast, and as evidenced by FIG. 2(B) showing the M-H loop of a perpendicular recording medium comprising a $(CoX/Pd)_n$ multilayer magnetic superlattice structure, such type media advantageously exhibit a relatively high coercivity, remanent squareness of about 1, and a negative nucleation field H_n, which characteristics are attributed to the high anisotropy energy of such type media arising from interfacial anisotropy effects. However, the grains of the multilayer magnetic superlattice structure tend to experience exchange coupling leading to transition noise. Moreover, notwithstanding the possibility of further improvements in multilayer magnetic superlattice structures for use in the fabrication of high recording density magnetic media, significant current issues/problems remain pertaining to the ability to manufacture such structures in a commercially viable manner.

It is believed that high areal recording densities of about 200 $Gbit/in^2$ or greater are possible with perpendicular magnetic media utilizing CoCr-based magnetic alloys as the magnetically hard recording layer. However, the obtainment of such high areal recording densities requires CoCr-based perpendicular media which exhibit the advantageous properties associated with multilayer magnetic superlattice-based media, i.e., high coercivity, remanent squareness of about 1, and a negative nucleation field H_n.

In view of the above, there exists a clear need for improved, high areal recording density, perpendicular magnetic information/data recording, storage, and retrieval media including CoCr-based magnetically hard recording layers, but which exhibit substantially increased signal-to-media noise ratios (SMNR), high coercivity, remanent squareness of about 1, and a negative nucleation field H_n. In addition, there exists a need

> for an improved method for manufacturing high areal recording density, perpendicular magnetic recording media employing CoCr-based magnetically hard recording layers which exhibit substantially increased SMNR, high coercivity, remanent squareness of about 1, and a negative nucleation field H_n, which media can be readily and economically fabricated by means of conventional manufacturing techniques and instrumentalities.
>
> The present invention addresses and solves problems attendant upon the use of CoCr-based magnetically hard recording layers in the manufacture of high bit density perpendicular magnetic media, e.g., noise generation which adversely affects the SMNR of the media, while maintaining all structural and mechanical aspects of high bit density recording technology. Moreover, the magnetic media of the present invention can be fabricated by means of conventional manufacturing techniques, e.g., sputtering".

In view of the above, it is evident that any determination of the patentability of the instantly claimed subject matter as a whole made under 35 USC § 103 (a) must take into account the following considerations:

At the time of applicants' invention, known CoCr-based perpendicular magnetic recording media were inferior to $(CoX/Pd)_n$ superlattice-based magnetic media in regard to several characteristics considered critical in obtaining high performance, low noise magnetic media, including high coercivity, remanent squareness approaching 1, and a negative nucleation field H_n. However, the manufacture of $(CoX/Pd)_n$ superlattice-based magnetic media entails several difficulties and/or drawbacks, primarily due to difficulty in depositing the large number n of (CoX/Pd) layer pairs required for the superlattice (i.e., n = 10 - 25), as well as the high manufacturing cost associated therewith.

By contrast, very high areal recording densities of about 200 $Gbit/in^2$ are considered possible with CoCr-based perpendicular magnetic recording media, which CoCr-based media can be manufactured at lower cost than the superlattice-based media. However, conventionally structured CoCr-based perpendicular magnetic recording media typically exhibit relatively low coercivities and remanent squareness, as well as positive nucleation fields. In addition, magnetic domain reversal within bits is problematic in causing media noise reducing the SMNR.

In view of the foregoing, it is evident that an ideal perpendicular magnetic recording medium is one which combines the high areal recording densities possible with

CoCr-based perpendicular media (as well as the ease of manufacture) and the advantageous recording properties associated with multilayer magnetic superlattice-based media, i.e., high coercivity (5,000 Oe or greater), remanent squareness of about 1, and a negative nucleation field H_n.

The present invention advantageously and unexpectedly achieves such result, i.e., CoCr-based perpendicular magnetic recording media having the high areal recording densities and lower manufacturing costs associated therewith while simultaneously exhibiting the high performance characteristics associated with $(CoX/Pd)_n$ superlattice-based media. According to the invention, CoCr-based perpendicular magnetic recording media exhibiting the advantageous properties of $(CoX/Pd)_n$ superlattice-based media (i.e., negative nucleation field, remanent squareness approaching 1, and high coercivity of at least about 5,000 Oe) are provided by utilizing specific combinations of at least one non-magnetic interlayer and the CoCr-based perpendicular magnetic recording layer.

Turning now to the Honda et al. and Futamoto et al. references relied upon by the Examiner in positing obviousness of the instantly claimed subject matter, the Examiner cites various portions of the reference as disclosing various materials and alloy compositions utilized for the various layers of perpendicular magnetic recording media, as well as variation of their thicknesses for adjustment of the performance characteristics of the media. The Examiner characterizes the instantly claimed invention as resulting from mere selection of appropriate materials and thicknesses of the magnetically soft underlayer, non-magnetic interlayer, and magnetically hard perpendicular recording layer from those disclosed by the applied references. Specifically, the Examiner posits that "the materials selected have been known in the art for perpendicular magnetic recording media and the selection of thickness are taught to be a matter of choice".

The Examiner's analysis, however, fails to take into account the unexpected result provided by the instantly claimed invention which could not reasonably be expected or predicted from the references, i.e., obtainment for the first time of readily manufactured CoCr-based perpendicular magnetic recording media exhibiting the advantageous performance characteristics associated with difficult-to-manufacture $(CoX/Pd)_n$ superlattice-based media. Specifically, nothing in either Honda et al. and Futamoto et al. indicates or remotely suggests that any combination of a non-magnetic interlayer and a

CoCr-based perpendicular magnetic recording layer, each having specific composition, can provide improved perpendicular magnetic recording media having a negative nucleation field H_n, remanent squareness approaching 1, and a high coercivity of at least about 5,000 Oe. By contrast, Honda et al. disclose formation of perpendicular magnetic recording media with substantially lower coercivities, i.e., on the order of 2,000 Oe (see, e.g., Col. 4, lines 55-58) and Futamoto et al. disclose substantially lower coercivities on the order of about 3,100 Oe (see Table 4), which relatively low coercivities are characteristic of CoCr-based perpendicular media. In addition, Honda et al. and Futamoto et al. are silent with respect to the advantage of forming CoCr-based perpendicular magnetic with a negative nucleation field H_n and remanent squareness approaching unity, each indicative of high anisotropy energy arising from interfacial anisotropy effects.

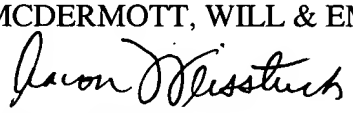
In summary, the instantly claimed invention is not the mere result of "routine optimization", i.e., selection of appropriate materials and layer thicknesses as "a matter of choice as posited by the Examiner. In point of fact, the instantly claimed invention, wherein improved perpendicular magnetic recording media having the advantages of high areal recording density and ease of manufacture of CoCr-based media and the advantageous performance characteristics of superlattice-based media are provided, is a significant advance over the prior art of record, which advance could not have reasonably been expected or predicted from the teachings of the applied references Honda et al. and Futamoto et al., taken singly or in combination.

In view of the foregoing, it is respectfully urged that the rejection of claims 1-13 and 19-20 under 35 USC § 103 (a) as unpatentable over the "admitted prior art" in view of Honda et al. and Futamoto et al. is improper, unwarranted, and lacking viability. Accordingly, withdrawal of the rejection and allowance of the application are courteously solicited.

To the extent necessary, a petition for an extension of time under 37 CFR § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such account.

Respectfully submitted,

MCDERMOTT, WILL & EMERY



Aaron Weisstuch, Ph.D.
Registration No. 41,557

600 13th Street, N.W.
Washington, DC 20005-3096
(202) 756-8000 AW:rrh
Facsimile: (202) 756-8087
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